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# ABSTRACT BOOK

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## May a tailing impoundment from an abandoned Pb-Zn mining activity be an environmental issue for water resources? Evidences from long-term groundwater monitoring

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Decommissioned mines represent a worldwide concern for the environment even for decades to hundreds of years since the activities ceased, and also in those areas located at long distances from the mining sites. The most important mining district of the Friuli Venezia Giulia region is the Pb-Zn Raibl mine, sited in the NE sector of the Julian Alps, near the border with Austria and Slovenia. The mine had a secular history since the first evidence of mining activity is dated to 1320 whereas its closure is dated back to 1991. Only in the 1976-1991 period, almost 4 million tons of mine tailings, products from milling and enrichment (flotation) processes of sphalerite (ZnS) and galena (PbS), have been stored in a tailings impoundment nearby the main stream flowing the area, the Rio del Lago creek. The tailings contain very high concentrations of base metals (Zn, Pb and Fe) and potentially toxic trace elements (PTEs: As, Cd, Tl, Sb). The site is currently under remediation to mitigate the impact on the environment, however, since the availability of such elements in the stream waters represent a concern for the freshwater ecosystem, the water quality is constantly monitored.

Ten years of groundwater monitoring results in several piezometers in the area conducted by ARPA FVG and the University of Trieste are presented. The time-series of the hydrochemistry evolution of tailings groundwaters has given the opportunity to observe the long- and short-term variations of elemental concentrations, thus suggesting the processes that lead the release of potential toxic elements (Tl, Zn and Pb) to groundwaters and some possible scenarios about future perspectives of contamination.

The short-term hourly data from groundwaters, entrapped in the tailing ponds, indicate high frequency relationship between hydrology and oxidation of sulfides that release PTEs. On the contrary, long-term hydrochemical series indicate that groundwaters inside the ponds are generally depleting in dissolved metals, due to both remediation actions and chemical depletion of the source. Groundwaters undergo a progressive enrichment of the main PTE concentrations, although this enrichment is limited to a few hundreds of meters downstream the impoundment.

Time-series analysis on the decay of PTEs performed with first-order rate constants (Newell et al., 2002), estimates that the dissolved metal contents in groundwater entrapped in the tailings could drop below the national law limits in a time interval from a couple of years to some decades. On the contrary, uncertain future scenarios about downstream enrichment have arisen.

Newell C.J., Rifai H.S., Wilson J.T., Connor J.A., Aziz J.A., & Suarez M.P. (2002) - Calculation and Use of First-Order Rate Constants for Monitored Natural Attenuation Studies. EPA: Ground Water Issue.